

### **AMENDMENTS TO THE SPECIFICATION**

Please amend the paragraph beginning at page 2, line 26, as follows:

In other words, the temperature of the chlorine dioxide bleaching stage used as the first stage in a bleaching sequence has been raised very slowly, in pace with the withdrawal of prejudice so that today the normal treatment temperature at the MC consistency stages varies within a wide range of the order of 45 - 70°C. Not until recently, around the middle of the 90's, the delignifying dioxide bleaching D<sub>0</sub> has been suggested to be performed at a higher temperature, i.e. at a temperature close to 100 degrees or even higher, in which case a completely pressurized process is used in order to prevent the water in the fiber suspension from boiling. However, in all cases the risk of deterioration of the pulp quality has been experienced. In the process technology in general, raising the temperature results in acceleration of chemical reactions and thus faster consumption of chemicals, and as a detrimental property when dioxide is used, an increase in the volume of ~~chlorine~~ chloride-containing exhaust gases. Further, at the high temperature of over 90°C, the danger of corrosion in the presence of ~~chlorine~~ chloride -containing liquid increases. Also, the temperature of over 90°C is difficult in view of the heat economy of the mill.

Amend the paragraph beginning at page 3, line 10, as follows::

Chlorine dioxide treatments are, because of their chemical character, divided in the bleaching sequences into two different stages each having their own purposes and process conditions. The so-called D<sub>0</sub> stage is a delignifying treatment stage, the main

purpose of which is to decrease the Kappa number of the pulp and the main reaction of which has been described in the wood chemical publications as an electrophilic stage. As publications discussing the subject are mainly more than ten years old the literature does not deal with a mere  $D_0$  stage but a combined CD stage is discussed, i.e. chlorination utilizing dioxide combined with elemental chlorine. The  $D_1$  and  $D_2$  etc. stages ~~in the subsequent~~ following later in the bleaching sequences are brightening stages which aim at increasing the brightness of the pulp and the chemical reaction of which is mainly nucleophilic. This has a different chemical character and totally different control parameters have influence on it than on a  $D_0$  stage. Literature (e.g. Pulp and Paper Manufacture, Volume 5, Alkaline Pulping, Tappi 1989) very clearly recommends, in particular for bleaching dioxide stages, a temperature of 50 - 90°C and a treatment time of more than two hours. The nucleophilic (brightening) and the electrophilic (delignifying) dioxide stage are separated in the literature based on the pH so that the former has a pH range of 1.8 - 4 and the latter a pH range of 3 - 6.5. Patent literature, however, mentions pH ranges of up to 8. The pH ranges mentioned overlap to some extent as the pH changes when the treatment stage proceeds and as the pH is adjusted according to the number, i.e. two or three, of the dioxide stages in the bleaching.

Amend the paragraph beginning at page 4, line 24, as follows:

The studies we have performed have shown that if the mixing of the pulp is efficient enough the chemical can be totally consumed in the chlorine dioxide stage in a short reaction time and at a remarkably lower temperature than is suggested by the kinetic model (Chlorine Dioxide Delignification Kinetics and Eop Extraction of Softwood Kraft Pulp, The Canadian Journal of Chemical Engineering, Volume 75, February 1997) which has recently been accepted in general discussion. In the tests we have performed, the chlorine dioxide mixed into the pulp was completely consumed in a few minutes already at a temperature of 60°C when the mixing was adequately efficient. The same kind of results were received from the treatment of pulp in tests in both one

stage and in several stages. An efficient laboratory reactor was used in all the tests. Although the temperature could not be proved to have a direct correlation with the decrease of the Kappa number, the chemical residue and the brightness of the pulp in this connection, its significance as a factor accelerating the reaction is known from prior art installations and the basic chemical literature and it has been proved also in other laboratory tests. Based on the tests, it is clear that the temperature need not be over 85 - 90°C in order to have a quick reaction. Thus, the kinetic model mentioned indicates a slower chemical consumption than it really is if the chemical is dosed using efficient mixing. The study leading to the kinetic model in question has been made in laboratory conditions and probably the test have not been made with modern laboratory reactors used now allowing fluidizing mixing. Thus in the kinetic model of the test, the reaction kinetics is limited by the mixing because the significance of the mixing has not been taken into account. Thus it can be concluded that raising the temperature, increasing the mixing efficiency and increasing the retention will compensate each other.

Amend the paragraph beginning at page 5, line 28, as follows:

SE-C2-504 210 deals with a multistage bleaching process in which chlorine dioxide is used in at least one stage. According to the publication, the chlorine dioxide stage is performed at a temperature of 90 – 130 degrees, at a pressure of 0.1 - 10 bar, at a consistency of 8 - 40 %, and with a retention time of 1 - 90 minutes. According to the publication, the pressurized dioxide stage mentioned is suitable for both the beginning and the end of the sequence. The method described in this patent publications is based on a study made by Sunds Defibrator Industries AB, which is also discussed in the article "Advancing the Chlorine Dioxide Process", Nordén & Mellander, The 12<sup>th</sup> Sunds Defibrator International Technical Seminar, May 29. – 31. 1996,

Sundsvall. The starting point of both the article mentioned and the patent publication is that the advantageous treatment time is 15 minutes or longer. Thus the reaction kinetics of the method described in the patent publication and the article mentioned corresponds to the kinetic model presented in the study mentioned above when the kinetic model is calculated for the temperature 90 - 130°C discussed.

Amend the paragraph beginning at page 6, line 18, as follows:

The prior art publications mentioned above disclose thus both the hot and the pressurized dioxide stage, as well as a two-step chlorine dioxide stage, in which only a short retention and mixing time do not suffice, even if it is intended particularly for a bleaching stage. The publications also partly aim at reducing the volume of chlorine dioxide to be used and at intensifying the bleaching process. However, these goals are striven for only by raising the temperature and by arranging the bleaching stage two-stepped. All the processes cited above have the typical feature that either the dioxide stage is very long, of the order of more than 30 minutes, or the stage is very hot and pressurized in which case the high temperature and the pressurization is considered to allow the use of a little shorter reaction time. However, none of the publications suggests performing the first chlorine dioxide treatment following the brown stock washing or oxygen bleaching with a treatment time if of a few minutes at a known low temperature when the pH is between 2 and 4 at the beginning of the treatment and between 2 and 3 at the end of it.

Amend the paragraph beginning at page 7, line 12, as follows:

~~The main objective~~ One of the main objectives of the present invention is to minimize the consumption of chlorine dioxide without compromising the efficiency and the result of the treatment.

Amend the paragraph beginning at page 7, line 29, as follows:

A fourth objective is to optimize the ratio of the mixing needed and the ~~reaction~~ reactor volume so that, by ensuring efficient mixing, the bleaching reaction is completed at the temperature of 50 - 85°C and at the same time to prevent high temperatures which are unfavorable in view of the heat economy. The objective is to reduce the corrosion risk of the stage by using a low temperature. The temperature is of essential importance also because with the temperature rise the treatment of exhaust gases becomes problematic. Temperatures below 90 degrees allow using indirect heating methods.

Amend the paragraph beginning at page 8, line 21, as follows:

In order to reduce the environmental load of a pulp mill, it is specifically desirable to reduce the volume of effluent from the bleaching process. Many industrial prior art installations have ended up in using the apparatus arrangement illustrated in Figure 1. However, already when deciding on the apparatus arrangement it has been known that recycling the reaction products from the washer subsequent to the treatment tower with the filtrate back to the pulp suspension will reduce the brightness of the pulp at the end

of the bleaching stage and increase the consumption of chemicals during the bleaching. This has been established also in our test, in which pulp was treated with recycled filtrate and clean water. When bleaching with recycled filtrate, the brightness of the pulp in the D<sub>0</sub> stage was reduced by 2 - 5 % (ISO) brightness units ~~compares~~ compared with pulp diluted with clean water.

Amend the paragraph beginning at page 11, line 28, as follows:

The second group involves destroying the dioxide discharged from the reactor with the pulp before the pulp is fed to a washer. The destruction of dioxide is usually performed by mixing chemical, in most cases sulphur dioxide water or sodium bisulphate into the pulp which reacts with the chlorine dioxide producing inert compounds which are easy to remove from the pulp during the wash. An essential feature in carrying out the process of our invention is that the chemical is mixed with the pulp very efficiently. The purpose is to distribute the chemical into the pulp so that it can react with the residual dioxide as fast as possible, i.e. before the pulp comes to the washer. Thus, the invention covers both ~~measured~~ measures aiming at fast consumption of chemicals and destroying the residual chemicals prior to the washer, which provides for the use of short retention times reliably and without risk.

Amend the paragraph beginning at page 12, line 11, as follows:

The methods and the apparatus ~~of the invention~~ according to the invention are described more in detail below with reference to the accompanying drawings of which

Amend the paragraphs beginning at page 12, lines 21-26, as follows:

Fig. 4 illustrates the ~~COD content of the fiber suspension liquid phase in different dioxide concentrations~~ change in the brightness of the fiber suspension in different

bleaching states determined based on our studies, as a function of the number of filtrate recycles;

Fig. 5 illustrates an apparatus arrangement for carrying out the chlorine dioxide treatment according to a preferred embodiment of the invention; and

Fig. 6 illustrates an apparatus arrangement for carrying out the chlorine dioxide treatment according to another preferred embodiment of the invention.

Amend the paragraph beginning at page 14, line 5, as follows:

In other words, the apparatus of the invention comprises a pump, from which pulp is pumped to a reactor, which due to the short reaction time may be a relatively short duct, a mixer placed preceding the pump if dioxide is not mixed in the pump, a mixing apparatus disposed substantially at the discharge end of the reactor vessel or in the vicinity of it ~~and~~ for mixing the chemical which eliminates the dioxide, and a washer. The essential feature of the apparatus described is that pulp travels from the dioxide mixing to the washer in a closed space and thus chlorine-containing compounds are prevented from escaping to the atmosphere.

Amend the paragraph beginning at page 15, line 5, as follows:

~~Figure 2 illustrates~~ Figures 2 and 4 illustrate the decrease in the final brightness as a result of the increase in the amount of reaction products in the bleaching sequence  $D_0$ -EP- $D_1$ . The horizontal axis in the figure illustrates how many times the filtrate from the washing stage ending the  $D_0$  stage was recycled back to the dilution preceding the  $D_0$  stage. The figure illustrates how the recycling times of the filtrate, i.e. in this case how many times there are reaction products from the  $D_0$  treatment present in the bleaching stage, decrease the brightness of the pulp and thus ~~creates~~ create needs to increase the amount of the chemical required in order to reach the desired brightness.

Since the retention is the same in each bleaching, the concentration of the reaction products from the bleaching has a significant role in the decrease of the brightness in this case. Figure 2 further indicates that the increase in the volume of reaction products does not affect strongly the brightness after the  $D_0$  stage but only the brightness after the EP and  $D_1$  stages which at its worst decrease by more than 10 ISO units.

Amend the paragraph beginning at page 16, line 1, as follows:

~~Figure 4 illustrates how filtrate from an oxygen stage, i.e. brown stock treatment, has been treated with chlorine dioxide solution under bleaching conditions. The results indicate that when the concentration of the bleaching chemicals at the beginning has been very high, the bleaching chemical has reacted with the COD of the filtrate so that the COD of the filtrate has not increased almost at all irrespective of the number of the recycling times. This is illustrated by the lowest of the three curves in Fig. 4. On the other hand, the tests showed that when the concentration of the bleaching chemical in the filtrate was 2 g/l calculated as active chlorine the chlorine-containing chemical is almost not at all active with the filtrate of the oxygen stage but the COD content of the liquid phase can rise relatively freely (the topmost curve). The third curve in Fig. 4 illustrates the chemical concentration of 2.5 g/l calculated as active chlorine and it can be seen that the COD content already rises to some extent, i.e. in practice the activity of the chlorine chemical relative to the filtrate of the oxygen stage has reduced remarkably. This speaks for arranging the chlorine dioxide stage so that the concentration of the bleaching chemical is not allowed to rise much over 2.5 g/l in the filtrate during one treatment stage or step.~~

Filtrate from an oxygen stage, i.e. brown stock treatment, was treated with chlorine dioxide solution under bleaching conditions. The results indicate that when the concentration of the bleaching chemicals at the beginning has been very high, the bleaching chemical has reacted with the COD of the filtrate so that the COD of the filtrate has not increased almost at all irrespective of the number of the filtrate recycling times.



On the other hand, the tests showed that when the concentration of the bleaching chemical in the filtrate was 2 g/l calculated as active chlorine the chlorine-containing chemical is almost not at all active with the filtrate of the oxygen stage but the COD content of the liquid phase can rise relatively freely. When the chemical concentration was 2.5 g/l calculated as active chlorine the COD content already rose to some extent, i.e. in practice the activity of the chlorine chemical relative to the filtrate of the oxygen stage has reduced remarkably. This speaks for arranging the chlorine dioxide stage so that the concentration of the bleaching chemical is not allowed to rise much over 2.5 g/l in the filtrate during one treatment stage or step.

Amend the paragraph beginning at page 16, line 16, as follows:

Thus, the present invention also relates to different ways of running bleaching processes according to a preferred embodiment of the invention so that the dioxide concentration in the fiber suspension to be treated remains less than 2.5 g/l, preferably less than 2.0 g/l calculated as active chlorine. The tests we have performed have indicated that the treatment time in the reaction vessel should be shorter than 10 minutes, preferably shorter than 7.5 minutes, more preferably shorter than 5 minutes. According to our tests the temperature of the pulp should be over 40°C whereby naturally the temperature and the treatment time are inversely proportional to each other, i.e. when the temperature is high the treatment time can be shorter and vice versa. The pH in turn should be 1.5 - 5.5, preferably 2 - 4.

Amend Table 2 beginning at page 18, line 20, as follows:

Table 2

D<sub>0</sub> stage

Consistency 10 %, amount of softwood pulp 135 g, Kappa 16.7, Viscosity 1108,  
 Brightness 35.5

| Code | Injection | Dilution             | Temp<br>°C | D dose<br>kg/adt | Time<br>min | Kappa<br>(after E stage) | Visco | Brightness                 |
|------|-----------|----------------------|------------|------------------|-------------|--------------------------|-------|----------------------------|
| 1    | 100%      | water                | 60         | 38.41            | 5           | 3.2                      | 1027  | 57.4                       |
| 2    | 100%      | water                | 70         | 38.41            | 5           | 3.3                      | 1036  | 57.2                       |
| 3    | 100%      | water                | 85         | 38.41            | 5           | 3.4                      | 1030  | 57.7                       |
| 4    | 50+50     | water                | 70         | 38.4             | 3+3         | 3.3                      | 1019  | 57.2                       |
| 5    | 50+50     | water                | 85         | 38.41            | 3+3         | 3.4                      | 992   | <del>8.1</del> <u>58.1</u> |
| 6    | 50+50     | D <sub>0</sub> clean | 70         | 38.41            | 2+2         | 3.3                      | 1007  | 55.3                       |
| 7    | 50+50     | D <sub>0</sub> clean | 85         | 38.41            | 3+3         | 3.5                      | 964   | 56.4                       |
| 8    | 100       | water                | 60         | 38.41            | 45          | 4.0                      | 1042  | 57.9                       |

Amend the paragraph beginning at page 19, line 14, as follows:

In tests 6 and 7, filtrate from a dioxide treatment was used in the dilution, the chemical was dosed in two stages and the treatment time in both the stages was in test 6 two minutes and in test 7 three minutes. Between the tests, the temperature was raised from 70 degrees to 85 degrees. Still the Kappa number and the brightness remained practically unchanged. It is worth noticing that neither a treatment time, which was 50 % longer, nor a temperature, which was 15 degrees higher, did bring a clear improvement in the results in test 7.

Amend the paragraph beginning at page 19, line 21, as follows:

~~Test 8~~ Comparative test 8, which was performed in a plastic bag, corresponds primarily to test 1, compared with which the only difference in addition to the chlorine dioxide mixing method is that the treatment time, 45 minutes, used in the test is the time given by the kinetic theory for a dioxide treatment performed at the temperature of 60 degrees. The results indicate that the Kappa number remains a little weaker ~~that~~ than in the tests 1 - 7 performed applying the method of our invention. On the average the same brightness was reached as in the tests simulating our ~~tests~~ invention.

Amend the paragraph beginning at page 20, line 8, as follows:

#### Example 2

130 g pulp having a consistency of 10 % and a Kappa number of 29.7 was supplied to the laboratory reactor used in the tests 1 - 7 of example 1. 60 kg/adt chlorine dioxide calculated as active chlorine was mixed into the pulp, the pulp was mixed well and the reaction was allowed to continue for three minutes at a temperature of 60°C. After this the residual chlorine dioxide was determined from the pulp; it was 0.2 kg/adt. In other words, more than 50 % larger dose of dioxide than used in tests of the previous example was practically all consumed in three minutes.

Amend the paragraph beginning at page 20, line 17, as follows:

Based on the test in example 2, it can be expected that it is possible in industrial scale to treat brown stock with chlorine dioxide amounts in of the order of 70 –80 kg/adt (calculated as active chlorine) at a temperature below 90°C and to bring the delignification process substantially to its end in less than ten minutes, preferably in a few minutes. In other words, compared with the kinetic model referred to above, only about one tenth of the time given in the model is needed for the reaction. In practice this can be transferred directly to the size of the reaction vessel, which may possibly be only a tube reactor instead of a large tower used today.

Amend the paragraph beginning at page 20, line 29, as follows:

According to a preferred embodiment of the invention, a probe measuring the chemical residue has been provided following the treatment vessel, which in some cases may be only a tube. When the chemical dose has been selected based on the lignin and the brightness indicator of the pulp, the temperature of the process is adjusted based on the residual chemical so that the whole chemical dose is consumed in the pulp suspension within the treatment time determined by the size of the treatment vessel and the production of the line.

Amend the paragraph beginning at page 21, line 16, as follows:

According to a further embodiment of the present invention, an essential part of the process is to guide the process with the temperature so that the process is in contact with the chemicals only as long as is necessary for the consumption of the bleaching chemical. In the prior art, i.e. in almost all the D<sub>0</sub> stages used in the world, the process conditions have been determined so carefully (mainly according to the

kinetic model already referred to earlier in several connections) that all the chemical is consumed much before the top of the tower and what is left at end stage is the reaction products and the pulp treated with the bleaching chemical. This gives a ~~change~~ chance to pulp quality losses, particularly to decrease of pulp brightness as by-reactions continue for a long time before the pulp bleaching stage ends, i.e. before the pulp arrives to a washer/press. The method according to our invention allows active adjustment of the bleaching reaction to continue during the whole retention of the reactor but prevents it from continuing to a level where the bleaching chemical has already been consumed and the quality losses begin to occur without the positive bleaching effect provided by the bleaching chemical.

Amend the paragraph beginning at page 21, line 24, as follows:

Figure 5 illustrates an apparatus according to a preferred embodiment of the invention for performing a chlorine dioxide bleaching stage  $D_0$ . It comprises a high-intensity, preferably a so-called fluidizing mixer 30, by means of which chlorine dioxide and if necessary either ~~oxygen~~ acid or alkali is mixed into the pulp in order to adjust the pH. Close to the mixer 30 in connection with the  $D_0$  stage, preferably prior to the mixer 30, a heater has been provided, which may be for example a direct or an indirect steam heater 32 or a liquid – liquid heater. After the chemical mixing and the heating, the pulp is guided to a reaction vessel, i.e. a treatment tower 34. After the tower 34, residual chlorine dioxide is determined from the pulp by a residue measurement, based on which it is possible, and in fact the intention, in this embodiment of the invention to adjust the temperature of the pulp, if necessary, preferably before the pulp is fed to the first mixer 30. If dioxide remains in the pulp after the reaction vessel 34, the temperature is raised by the heater 32 and, after the retention of the treatment stage, it is checked if there still is dioxide left in the pulp. On the other hand, if all the dioxide has been consumed the temperature may be decreased in order to increase the treatment time. By this measure it can be ensured that the whole treatment time is used in a beneficial bleaching

reaction. At the same time, the time is minimized during which the pulp is in contact with the reaction products. From the residue measurement 36 the pulp flows in this embodiment to another mixer 38, in which a new dose of chlorine dioxide is mixed and, if necessary, chemical needed for the adjustment of the pH. Another heater 40 has been provided in connection with the mixer 38, by means of which the temperature of the second step may be raised, if necessary. After this the pulp is guided to another treatment vessel or tower 42 and from there further to a washer 44.

Amend the paragraph beginning at page 24, line 1, as follows:

When the process apparatus described above is desired to be used as optimally as possible it works so that so much chlorine dioxide is dosed to the first treatment step, i.e. to the mixer 30, that its consistency in the fiber suspension becomes less than 2.5 g/l, preferably ~~2.9~~ 2.0 g/l calculated as active chlorine. In most cases this dose can be performed by calculating in relation to the pulp flow as the travel of chlorine dioxide counter-currently from the filtrates obtained from wash stages subsequent to the process is prevented. The bleaching stage tower is used, in the process sense, to refer to the retention taking place after the mixing, which retention may also be realized for example by a tube or an enlargement of a tube. The bleaching stage and the retention after it have been dimensioned in the process for a certain production whereby the residue measurement has been provided, in view of the adjustability of the process, advantageously in the discharge of the pulp; based on the measurement the heating of the pulp prior to its feeding ~~of it~~ to the reaction vessel and the amount of chlorine dioxide to be fed may be controlled so that the residue remains, according to one way of operation, practically at zero. According to another way of operation, the temperature of the pulp to be fed to another mixer is adjusted based on the residue measurement at the discharge of the tower so that if some unreacted dioxide has remained in the pulp in the first tower, the residue after the second tower does not remain detrimentally high.

Amend the paragraph beginning at page 24, line 21, as follows:

Figure 6 illustrates a bleaching apparatus according to yet another preferred embodiment of the invention. The embodiment of Figure 6 differs from the one in Figure 5 in fact only in that in the embodiment illustrated in Figure 6 the process apparatus comprises three subsequent treatment towers. The apparatus embodiment depends mainly on the fact that it may be necessary in the  $D_0$  stage to reduce the Kappa number, i.e. the lignin content of the pulp more than can be achieved in two towers using the low dioxide contents of the invention. Then it is sensible to divide the chlorine dioxide dose into three substantially equal portions so that the dioxide content in each tower remains under the limit value given above and on the other hand the chemical consumption is even.

Amend the paragraph beginning at page 25, line 7, as follows:

Thus it is clear that the bleaching process according to the invention may be adapted to the required decrease in Kappa number merely by changing the number of treatment towers. It should be noted that even if this seems now to be a solution involving expensive apparatus, it is quite the opposite. If the initial situation is that prior art dioxide treatments require treatment times of 0.5 – 1 hour, they have to be performed in large bricked bleaching towers. A bricked tower instead of an ordinary metal tower is required because of the strong corrosive influence of chlorine dioxide. Now, when treatment times of only ~~of~~ in the order of 1 – 10 minutes are required, a substantially smaller treatment vessel is required, which may be even a glass fiber or standard tube vessel, which is small compared with the conventional towers, and the manufacturing costs as well as construction, erection, isolation and instrumentation costs of it are only a fraction of those of the corresponding prior art bricked towers.

**AMENDMENTS TO THE CLAIMS:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (currently amended) A method of treating pulp with chlorine dioxide according to which chlorine dioxide is mixed in the pulp and the mixture thus produced is fed into a treatment vessel in which the chlorine dioxide treatment is carried out at a temperature of 40 – 90°C and at a pH of 1.5 – 6.5, characterized in that the treatment time in each chlorine dioxide treatment vessel or each chlorine dioxide treatment step is less than 10 minutes, chlorine dioxide is mixed in the pulp by using intensive mixing and the discharge of the pulp from the treatment vessel ~~straight~~ to a chlorine dioxide stage washer is arranged to take place in a closed space ensuring that no detrimental amounts of residual dioxide remain in the pulp flowing to the washer.
2. (original) A method as claimed in claim 1, characterized in that when pulp is being discharged from the treatment vessel, chemical is added into the pulp to deactivate the residual dioxide.
3. (original) A method as claimed in claim 2, characterized in that the chemical addition mentioned is performed with a fluidizing high-intensity mixer.
4. (original) A method as claimed in claim 3, characterized in that the high-intensity mixer mentioned is a static mixer or a valve over which an adequate pressure difference is ensured.
5. (original) A method as claimed in claim 3, characterized in that the high-intensity mixer mentioned is a fluidizing discharger or a fluidizing centrifugal pump serving as a discharger.



6. (currently amended) A method as claimed in claim 1, characterized in that the chlorine dioxide residue is determined from the pulp at the end of the treatment vessel or after the treatment vessel.
7. (currently amended) A method as claimed in claim 6, characterized in that the chlorine dioxide residue is used to adjust a parameter influencing the speed of the bleaching reaction, for example temperature, pressure, or the revolution speed of the mixer.
8. (currently amended) A method as claimed in claim 7, characterized in that the chlorine dioxide residue is used to adjust the temperature which is used to control the chlorine dioxide bleaching reaction to last for substantially the retention time from the mixer to the treatment vessel discharge.
9. (previously presented) A method as claimed in claim 1, characterized in that the treatment is carried out in several steps.
10. (original) A method as claimed in claim 9, characterized in that the dioxide stage is two-stepped, whereby about 5 – 25 kg/adt of chlorine dioxide calculated as active chlorine is dosed into each treatment step.
11. (original) A method as claimed in claim 1, characterized in that the pulp to be treated is pulp, which has been screened and washed, or screened, washed and oxygen bleached, or screened, washed and ozone treated after digestion.
12. (original) A method as claimed in claim 1, characterized in that the chlorine dioxide treatment in question is a bleaching D<sub>o</sub> stage removing lignin.

13. (original) A method as claimed in claim 1, characterized in that, when mixing dioxide into the pulp, intensive mixing compensates temperature whereby the dioxide treatment may be performed at a lower temperature than conventionally.
14. (currently amended) A method as claimed in claim 1, characterized in that the chlorine dioxide concentration in the fiber suspension liquid phase is substantially throughout the whole treatment less than 2.5 kgg/l calculated as active chlorine.
15. (original) A method as claimed in claim 1, characterized in that the volume of the detrimental residual dioxide depends on the material of the washer used, which residual dioxide volume may be determined both experimentally and based on studies to a level ensuring adequate life.
16. (previously presented) A method as claimed in claim 2, characterized in that the treatment is carried out in several steps.
17. (previously presented) A method as claimed in claim 16, characterized in that the dioxide stage is two-stepped, whereby about 5 – 25 kg/adt of chlorine dioxide calculated as active chlorine is dosed into each treatment step.

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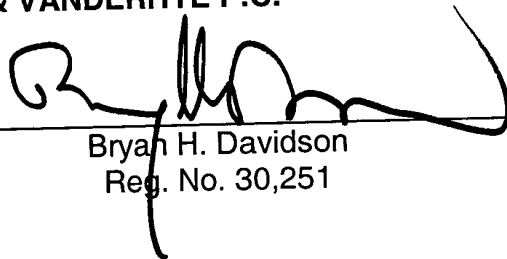
**REMARKS**

While reviewing the corresponding European application preparatory to its grant on September 17, 2003, the applicants' foreign associates noted and corrected several minor errors in the text. The same corrections are being made in the present application and entry of these amendments is requested.

Respectfully submitted,

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